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CHEMICAL CONTROL OF BOSTRICHIDAE DURING AIR DRYING OF FENCE POSTS

BY

R. S. BOONE, M. CHUDNOFF, AND

E. GOYTIA

INSTITUTE OF TROPICAL FORESTRY

RIO PIEDRAS, PUERTO RICO

FOREST SERVICE

U. S. DEPARTMENT OF AGRICULTURE

RESUMEN

Generalmente los postes de diámetro pequeño requieren un secado al aire de alrededor de tres meses para alcanzar un contenido de humedad que sea compatible con un tratamiento de baño caliente y frio u otro tratamiento de preservación de madera duradero.

Durante este perîodo de secado y durante cualquier perîodo de almacenaje en Puerto Rico, estos postes son vulnerables al ataque de un bostrichid (Tetrapriocera longicornis). La infestación puede llegar a ser tan severa que los postes dejan de ser adecuados para cercas. Combinaciones de Borax y BHC no han sido efectivas; por lo tanto, se han investigado otros insecticidas y métodos de aplicación utilizando postes de mangle blanco (Laguncularia racemosa) como huésped.

Los tratamientos fueron: (1) dieldrin disuelto en aceite diesel en concentraciones de 0.25, 0.50 y 1.00 por ciento, aplicado por inmersión dentro de 48 horas después de cortados; (2) 0.50 por ciento dieldrin en agua aplicado por inmersión; (3) 0.50 por ciento dieldrin aplicado como en el número (1) arriba y una y dos semanas después de cortados; (4) 0.50 por ciento dieldrin en aceite diesel aplicado por aspersión a los intervalos de tiempo mencionados en el número (3); (5) concentraciones de clordano al .50 y 2.00 por ciento en aceite diesel, aplicado como en el número (1); (6) 5 por ciento de pentaclorofenol disuelto en aceite diesel y aplicado como en el número (1); (7) aceite diesel solamente aplicado como en el número (1), y (8) control sin tratamiento.

Los resultados indican que en el tratamiento número (1) hay una reducción en el por ciento de postes atacados con el aumento en la concentración, pero la infestación es insignificante para estas combinaciones. El agua es menos efectiva que el aceite como agente transportador. Una dilación hasta de dos semanas es tan efectiva como los tratamientos inmediatos después del corte (3). El tratamiento (4) indica que la aspersión es menos efectiva que la inmersión. Clordano (5) a doble concentración es menos efectivo que el dieldrin. Los tratamientos (6) y (7) no son efectivos ya que los postes tratados por inmersión tienen infestaciones tan severas como los no tratados usados como control (8). Este bostrichid puede atacar no solamente madera cortada recientemente, sino también material secado al aire que esté almacenado.

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R. S. Boone, M. Chudnoff, and E. Goytía
Institute of Tropical Forestry
Forest Service, U. S. Department of Agriculture
Río Piedras, Puerto Rico[1/]

SUMMARY

Small-diameter posts generally require an air drying period of about three months to reach a moisture content compatible with a hot-and-cold bath or other long-lasting wood preservation treatment. During this drying time and during any subsequent storage period in Puerto Rico, these posts are vulnerable to borer attack by a bostrichid (Tetrapriocera longicornis). Infestations may become so severe that the posts are no longer suitable for fencing. Borax and BHC formulations have not been effective, so, other insecticides and methods of application have been investigated using white mangrove (Laguncularia racemosa) posts as a host.

Treatments were: (1) dieldrin dissolved in fuel oil at 0.25, 0.50, and 1.00 percent concentrations applied as a dip within 48 hours of felling; (2) 0.50 percent dieldrin in a water carrier applied as a dip; (3) 0.50 percent dieldrin applied as in (1) above and one week and two weeks after felling; (4) 0.50 percent dieldrin in a fuel oil carrier applied by spray at time intervals given in (3); (5) 0.50 and 2.00 percent concentrations of chlordane in a fuel oil carrier and applied as in (1); (6) 5 percent pentachlorophenol dissolved in fuel oil and applied as in (1); (7) fuel oil alone applied as in (1); and (8) non-treated controls.

Results show that in treatment (1) there is a decrease in percentage of posts attacked with increase in concentration, but infestations are negligible for these formulations. A water carrier (2) is less effective than an oil carrier. A delay of as much as two weeks is as effective as treatments soon after felling (3). Treatment (4) shows spraying to be less effective than dipping. Chlordane (5) at double the concentration is less effective than dieldrin. Treatments (6) and (7) are not effective as dipped posts sustain infestations as severe as non-treated controls (8). This bostrichid can attack not only freshly felled wood, but can also infest air-dried material in storage.

1/ In cooperation with the University of Puerto Rico.

INTRODUCTION

There is an estimated market potential for about one million preservative treated fence posts per year in Puerto Rico (3). Preparing posts for this chemical protection requires that they be cut, peeled, stacked, and allowed to air-dry until they reach a moisture content of 20-25 percent. In the San Juan area this takes about three months. The posts are then receptive to cold-soaking, hot-and-cold bath, or pressure processes that will impart long-lasting protection against insect and fungus attack.

During the air drying period, posts of a number of tree species are usually attacked by a powder-post beetle of the family Bostrichidae (1). Typical damage includes larval galleries with tightly packed powdery borings. Advanced attack may leave the sapwood nearly reduced to dust covered by a thin papery shell unable to hold staples or nails. If the susceptible sapwood constitutes a large volume of the post, there is a severe reduction in strength.

The species of Bostrichidae most commonly associated with attack in drying fence posts has been identified as Tetrapriocera longicornis Olivier. White mangrove or mangle blanco (Laguncularia racemosa (L.) Gaertnif) is a wood readily available for fence posts and is one of the starch-rich species most susceptible to this insect attack.

Previous attempts to control the beetle using a water carrier containing 1.8 percent borax, 0.8 percent sodium pentachlorophenate, and 0.5 percent gamma isomer of benzene hexachloride (BHC) were not successful. Within two or three months after treatment, white mangrove posts would be completely riddled with larval galleries and no longer suitable for fencing. To eliminate or minimize these losses, several other insecticides and methods of application were investigated.

MATERIALS AND METHODS

Preliminary screening tests using 10-second dips at 0.5 percent concentration of BHC, dieldrin, chlordane, and aldrin in a fuel oil carrier were made using white mangrove billets as host. After 18 weeks exposure, the effectiveness of these chemicals, based on severity of larval attack, was rated in decreasing order as follows: dieldrin, aldrin, BHC, chlordane. Dieldrin was chosen for more intensive evaluation. Chlordane was also selected for further trial because of its low cost, less than half that of dieldrin. A 5 percent concentration of pentachlorophenol dissolved in fuel oil was included because of its availability at most treating plants. In India, a dip in oil alone has been recommended (2).

Posts

Highly vulnerable all-sapwood posts of white mangrove, with diameters ranging from 2 to 4 inches, were used as the host species. Regular lengths of 6 to 7 feet were used for spray treatments, and short billets (32 inches) were used for dip treatments. Bark was peeled from all material within 48 hours of felling.

Treatments

Fourteen treatments, including controls, were used. They are: (a) dieldrin dissolved in No. 2 fuel oil at three concentrations... 0.25, 0.50, and 1.00 percent[1/] applied as a 10 second dip within 48 hours of felling; (b) 0.50 percent dieldrin in a water carrier applied as a dip within 48 hours of felling; (c) 0.50 percent dieldrin dissolved in fuel oil and applied as a dip one week and two weeks after felling; (d) 0.50 percent dieldrin in a fuel oil carrier applied by spray at three time intervals... 48 hours, one week, and two weeks after felling; (e) chlordane dissolved in fuel oil at two concentrations (0.50 percent and 2.00 percent) applied as a dip within 48 hours of felling; (f) 5 percent pentachlorophenol in fuel oil applied as a dip within 48 hours of felling; (g) No. 2 fuel oil dip within 48 hours of felling; (h) controls - no treatment.

There were 20 replicates for each dip treatment stacked for drying in separate crib piles. Posts to be sprayed were self-stickered in piles of 50 each. A total of 130 non-treated control sticks were used; 30 were in a separate pile and 10 intermixed in each of the 10 dip-treated piles.

Sticks were submerged in the treating solutions for 10 seconds. Surface liquid was allowed to drain prior to placement in the separate self-stickered piles. A knap-sack type pressure tank with a coarse mist nozzle was used to spray the piled posts. The volume of spray applied was twice that held by the surface of a dipped green post or at a rate of 360 grams per square meter. All piles were off the ground and unroofed to simulate field exposure conditions.

Inspections

After 16 weeks (April-August) of exposure, 50 percent of the sticks was randomly selected from each treatment and examined for larval damage. The remaining posts were left in piles for an additional eight weeks or a total drying and storage period of 24 weeks. It should be noted that mass emergence of a new adult population of the insects began 14 weeks after felling. The shorter dip-treated pieces were cross-cut about five inches from either end and at the middle. The full-length sprayed posts were cross-cut at four 20-inch intervals. Damage ratings of the exposed cross-sectional areas were assigned on the following log base scale: 100 – no attack, 90 – slight attack, 70 – moderate attack, 40 – severe attack, and 0 – very severe attack (figure 1). Posts having more than slight attack (ratings less than 90) were classified as rejects.

RESULTS AND DISCUSSION

The various treatments, percentages of posts showing attack, and percent rejects are presented in table 1. Attack and damage were evaluated only on the sampled cross-sectional areas. In some instances test sticks showed entry holes, but when sectioned, there were no signs

1/ All formulations on a weight basis.

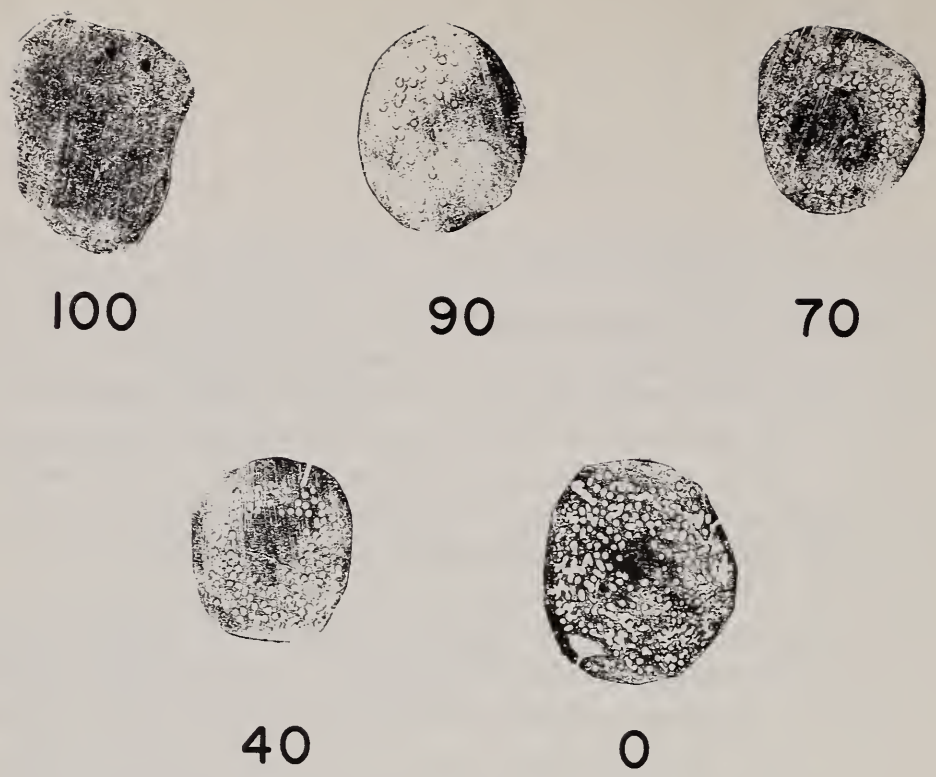

Figure 1.—Range of larval degradation classified on a log base scale where 100 = no attack, and 0 = very severe attack. Posts rated less than 90 are rejects (see table 1). Illustrations are photographs of "rubbings".

Figure 2.—Typical egg galleries where reproduction aborted.

of larval activity. Where only egg galleries were present (see figure 2) the attack was considered aborted and rated as no attack. Data is given for exposures of 16 weeks and 24 weeks from time of felling.

As shown in table 1, the effectiveness of dieldrin, applied within 48 hours of felling, increases with increase in concentration; particularly after 24 weeks of exposure. That is, an oil dip with concentrations of 0.25, 0.50, and 1.00 percent dieldrin resulted, respectively, in 30, 20, and 10 percent of the posts being attacked. Severity of larval damage, however, for all these treatments were negligible. A delay in the 0.50 percent dieldrin-in-oil dip treatment of one or two weeks has as good as or better suppression of insect attack than the treatment of freshly cut material. Spraying this 0.50 percent dieldrin concentration is not as effective as dipping. After long-time storage, one-third to one-half of these sprayed posts were infested. As much as 20 percent are rejects due to severe larval activity.

The use of 0.50 percent dieldrin in a water carrier for dip treatments is not as effective as the fuel oil carrier. After 24 weeks of drying and exposure to the weather, billets treated with the former had 20 percent rejects as compared with only 10 percent for the latter.

Chlordane dip treatments at double the dieldrin concentrations are considerably less effective than dieldrin. Seventy percent of the sticks were attacked after 24 weeks of exposure. Increasing the concentration fourfold from 0.50 percent to 2.00 percent had little effect. Severity of larval activity, however, is rather moderate with rejects of 10 to 20 percent. The large increase of percentage of sticks infested from 10-20 percent after 16 weeks exposure to 60-70 percent after 24 weeks does suggest that chlordane is toxic over a rather short period.

A 5 percent concentration of pentachlorophenol in oil, or a dip of No. 2 fuel oil alone show 80-100 percent attack of test pieces with over 50 percent loss due to rejects (24 week exposure). This severity of attack is comparable to, if not worse than, the degradation of the non-treated controls.

From the above, then, a 0.50 percent concentration of dieldrin in a fuel oil carrier, applied by dipping to a highly vulnerable species, within two weeks of felling, will give excellent protection against bostrichids for 16 weeks. Somewhat lesser protection is afforded over a 24-week exposure period. For almost all treatments (exception is pentachlorophenol) the number of sticks attacked increases with exposure time. This strongly suggests that the Tetrapriocera longicornis adult cannot only penetrate freshly felled wood but also tunnel fairly dry material and deposit viable eggs.

Howick (4) reports that Australian bostrichids seldom attack after wood has dried below the fiber saturation point. White mangrove posts reach this moisture content after only 4 to 6 weeks of air drying.

Table 1.—Treatments of white mangrove posts and larval attack by bostrichids (Tetrapriocera longicornis)—a powder post beetle

Treatment	Pct. Conc.	Carrier	Time delay between peeling and application	Pct. posts [1] showing attack after exposure of		Pct. rejects [2] due to severity of attack after exposure of	
				16 weeks	24 weeks	16 weeks	24 weeks
Control	--	--	--	51	73	49	54
			DIP				
Dieldrin	0.25	No. 2 fuel oil	48 hours	20	30	10	0
"	0.50	"	"	0	20	0	10
"	1.00	"	"	0	10	0	0
"	0.50	Water	"	20	30	10	20
"	0.50	No. 2 fuel oil	1 week	0	10	0	0
"	0.50	"	2 weeks	0	0	0	0
Chlordane	0.50	"	48 hours	20	70	20	20
"	2.00	"	"	10	60	0	10
Pentachloro-phenol	5.00	"	"	80	80	80	70
Fuel oil (alone)	--	--	"	60	100	30	60
			SPRAY				
Dieldrin	0.50	No. 2 fuel oil	48 hours	16	33	16	21
"	0.50	"	1 week	24	29	8	8
"	0.50	"	2 weeks	40	54	28	16

1/ For each exposure period, 10 test posts treated by dipping and 25 posts treated by spraying were sampled. Sixty five control posts represent each exposure period.

2/ Posts having insect damage ratings less than 90 are considered rejects – see figure 1.

Since this study was completed, 175 billets representing some 35 species of tropical hardwoods were given this 0.50 percent dieldrin-in-oil dip treatment while in the green condition. After about 8 months of drying and storage under cover, there has not been a single attack by Bostrichidae or Lyctidae. Material included highly susceptible sapwood of granadillo (Buchenavia capitata (Vahl) Eichl.), moca (Andira inermis (W. Wright) H.B.K.), and algarrobo (Hymenaea courbaril L.). In the past, these same species, when given a dip treatment using BHC, borax, and sodium pentachlorophenate, were completely destroyed by Lyctus larvae in a few months.

CONCLUSIONS

Conclusions from this study to develop an effective control of Bostrichidae are as follows:

1. Increase in a dieldrin-in-oil concentration does lower the percentage of posts attacked. Severity of larval damage, however, is negligible for all concentrations tested; i.e., 0.25, 0.50, and 1.00 percent.

2. Dip treatments using 0.50 percent dieldrin in a fuel oil carrier may be delayed up to two weeks from time of felling.

3. Dipping in a 0.50 percent concentration of dieldrin in a fuel oil carrier is more effective than spraying.

4. Posts dip-treated with dieldrin in a fuel oil carrier were less severely attacked than those treated using a water carrier.

5. Chlordane treatments at double the dieldrin concentrations are less effective. There is a considerable drop in toxicity over an extended exposure period.

6. A 5 percent concentration of pentachlorophenol or a dip treatment of fuel oil alone sustain larval attack as severe as non-treated wood.

7. The bostrichid Tetrapriocera longicornis cannot only penetrate and attack freshly felled wood but can infest air-dried wood as well.

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CAUTION:--Dieldrin and the other insecticides are extremely toxic and if improperly handled, may be injurious to humans, domestic animals, fish, and wildlife. They may contaminate water supplies and will leave residuals in the soil for many years. Store in plainly labeled containers away from food products. In handling these chemicals, follow the directions and heed precautions given on the container. Take extra care not to let them come in contact with the skin or clothing. If spilled, wash skin thoroughly with soap and water, remove clothing and launder before wearing again. Rubber gloves, goggles, and face masks should be worn as appropriate. Do not dispose of chemicals where they will contaminate water supplies or where food crops are grown.

Boone, R.S., Chudnoff, M., and Goytía, E.
1969. Chemical control of Bostrichidae during air drying of fence posts. Inst. Trop. Forestry, U.S. Forest Serv. Res. Paper ITF-8.

The effectiveness of several treatments to protect highly vulnerable starch-rich white mangrove or mangle blanco (Laguncularia racemosa) from attack by bostrichids (Tetrapriocera longicornis) during air drying and storage is described. Dip treatments were: 3 concentrations of dieldrin in a fuel oil carrier applied to posts at 3 time intervals after felling; one concentration of dieldrin in a water carrier; 2 concentrations of chlordane-in-oil; 1 concentration of pentachlorophenol, and fuel oil alone. One concentration of dieldrin-in-oil was also applied by spraying at 3 time intervals after felling. Results show that a dip of 0.50 percent dieldrin-in-oil, applied to posts within 2 weeks of felling gives excellent protection against the bostrichid as well as lyctus beetles during at least a 6-month drying and storage period.

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